# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

**(PCT Article 36 and Rule 70)**

14



| Applicant's or agent's file reference YMEDIA.001VP | **FOR FURTHER ACTION** | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |
|---|---|---|
| International application No. PCT/US00/22772 | International filing date *(day/month/year)* 18 AUGUST 2000 | Priority date *(day/month/year)* 19 AUGUST 1999 |
| International Patent Classification (IPC) or national classification and IPC IPC(7): H04N 9/64, 9/04, 5/335 and US Cl.: 348/272, 256, 242 | | |
| Applicant YMEDIA CORPORATION | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 8 sheets.

   ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 0 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of report with regard to novelty, inventive step or industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

| Date of submission of the demand | Date of completion of this report |
|---|---|
| 27 FEBRUARY 2001 | 15 OCTOBER 2001 |
| Name and mailing address of the IPEA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231<br>Facsimile No. (703) 305-3230 | Authorized officer<br>FOR<br>Andrew B. Christensen<br>Telephone No. (703) 308-9644 |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US00/22772

## I. Basis of the report

1. With regard to the **elements** of the international application:*

[X] the international application as originally filed

[X] the description:
pages 1-21 , as originally filed
pages NONE , filed with the demand
pages NONE , filed with the letter of _____

[X] the claims:
pages 22-28 , as originally filed
pages NONE , as amended (together with any statement) under Article 19
pages NONE , filed with the demand
pages NONE , filed with the letter of _____

[X] the drawings:
pages 1-29 , as originally filed
pages NONE , filed with the demand
pages NONE , filed with the letter of _____

[X] the sequence listing part of the description:
pages NONE , as originally filed
pages NONE , filed with the demand
pages NONE , filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

[ ] the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

[ ] the language of publication of the international application (under Rule 48.3(b)).

[ ] the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

[ ] contained in the international application in printed form.

[ ] filed together with the international application in computer readable form.

[ ] furnished subsequently to this Authority in written form.

[ ] furnished subsequently to this Authority in computer readable form.

[ ] The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

[ ] The statement that the information recorded in computer readable form is identical to the writen sequence listing has been furnished.

4. [X] The amendments have resulted in the cancellation of:

[X] the description, pages NONE

[X] the claims, Nos. NONE

[X] the drawings, sheets/~~fig~~ NONE

5. [ ] This report has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

***Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. statement

| | | | |
|---|---|---|---|
| Novelty (N) | Claims | (Please See supplemental sheet) | YES |
| | Claims | (Please See supplemental sheet) | NO |
| Inventive Step (IS) | Claims | (Please See supplemental sheet) | YES |
| | Claims | (Please See supplemental sheet) | NO |
| Industrial Applicability (IA) | Claims | (Please See supplemental sheet) | YES |
| | Claims | (Please See supplemental sheet) | NO |

2. citations and explanations (Rule 70.7)

A. Claims 1, 3, 6, 7, 9, 10, 13-16, 18, 22, 25, 27-29, 31, 32, 34, 36 and 43 lack novelty under PCT Article 33(2) as being anticipated by Boisvert et al. (U.S. Patent No. 5,329,312).

Regarding Claim 1, Boisvert et al. disclose a color imaging system providing on-the-fly color interpolation using analog signals to reconstruct colors during sensor readout (See Column 14, Lines 26-27 where a modified signal level of a respective color signal is inserted between its preceding and its following color signals by means of the sequential gain control), comprising an array of pixel sensor elements (12); a color filter including a plurality of color filter components organized in a predefined pattern, the color filter overlaying at least a portion of the array (Column 6, Lines 28-30); a readout control circuit (Column 6, Lines 30-38); an array controller (Figures 1 and 2) coupled to the array, wherein the readout circuit and the array controller reconstruct color components for at least a portion of the array while the readout control circuit is reading at least the portion of the array (Column 6, Lines 38-45).

Regarding Claim 3, Boisvert et al. disclose that the readout control circuit is adapted to read a plurality of pixel sensor elements in parallel (Figure 1).

Regarding Claim 6, Boisvert et al. disclose that the readout control circuit is programmable to read a first pixel element in a first mode and to read a second pixel element in a second mode (See Column 1, Line 57; NTSC, where the first mode is for odd pixels and the second mode is for even pixels).

Regarding Claim 7, Boisvert et al. disclose that the pixel elements form a portion of a CCD (Column 6, Lines 16-17).

Regarding Claim 9, Boisvert et al. disclose a first programmable gain amplifier adapted to amplify a first color readout signal a first amount and a second programmable gain amplifier adapted to amplify a second color readout signal a second amount (Figure 1; Column 5, Lines 16-18 and 40-41).

(Continued on Supplemental Sheet.)

## VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claim 1 is objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because the claim is indefinite for the following reason: there is no antecedent basis for "the readout circuit" in line 7.

Claim 45 is objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because the claim is indefinite for the following reason: there is no antecedent basis for "the first pixel" in line 3 and "the second pixel" in line 5.

Claim 51 is objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because the claim is indefinite for the following reason: there is no antecedent basis for "the readout controller" in line 3.

**Supplemental Box**
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII Sheet 10

V. 1. REASONED STATEMENTS:
The report as to Novelty was positive (YES) with respect to claims 2,4,5,8,11,12,17,19-21,23,24,26,30,33,35,37,42.
The report as to Novelty was negative (NO) with respect to claims 1,3,6,7,9,10,13-16,18,22,25,27-29,31,32,34,36,38-41,43-52.
The report as to Inventive Step was positive (YES) with respect to claims NONE .
The report as to Inventive Step was negative (NO) with respect to claims 1-52.
The report as to Industrial Applicability was positive (YES) with respect to claims 1-52 .
The report as to Industrial Applicability was negative (NO) with respect to claims NONE .

V. 2. REASONED STATEMENTS - CITATIONS AND EXPLANATIONS (Continued):

Regarding Claim 10, Boisvert et al. disclose that the programmable gain amplifiers are implemented as a separate stage (Figure 2).

Regarding Claim 13, Boisvert et al. disclose that the programmable gain amplifiers have different transfer functions (Column 5, Lines 16-17).

Regarding Claim 14, Boisvert et al. disclose that at least a portion of the pixel sensor elements are active (Column 6, Lines 30-38).

Regarding Claim 15, Boisvert et al. disclose that at least a portion of the pixel sensor elements are passive (Column 12, Lines 27-30).

Regarding Claim 16, Boisvert et al. disclose that at least a first pixel sensor element is associated with a different color filter component than a neighboring pixel sensor element (Column 6, Lines 28-29).

Regarding Claim 18, Boisvert et al. disclose that the predefined pattern comprises the colors of red, blue and green (Column 6, Line 29).

Regarding Claim 22, Boisvert et al. disclose that the readout control circuit and the array controller process a first set of pixel sensor elements and then process a second set of pixel sensor elements, such that the second set of pixel sensor elements does not overlap the first set of pixel sensor elements (Column 12, Lines 28-31; row by row readout).

Regarding Claim 25, Boisvert et al. disclose a television coupled to the readout control circuit (Column 1, Line 20).

Regarding Claim 27, Boisvert et al. disclose a monitor coupled to the readout control circuit (Column 1, Line 20).

Regarding Claim 28, Boisvert et al. disclose a camera coupled to the readout control circuit (Column 1, Lines 17-18).

Regarding Claim 29, Boisvert et al. disclose a method of interpolating color components of an array of pixel sensor elements, the method comprising reading a portion of an array of pixel sensor elements and reconstructing color components fore at least a portion of the array while the portion of the array is being read (See Column 6, Lines 31-45 where a modified signal level of a respective color signal is inserted between its preceding and its following color signals by means of the sequential gain control).

Regarding Claims 31 and 32, Boisvert et al. disclose that reconstructing color components is performed in real time and in the analog domain (Column 6, Lines 31-45).

As to Claim 34, see the discussion of Claim 22.

Regarding Claim 36, Boisvert et al. disclose summing a plurality of values associated with a plurality of pixel sensor elements associated with a first color (Red) to produce a first color component and summing a plurality of values associated with a plurality of pixel sensor elements associated with a second color (Blue) to produce a second color component (See Column 8, Lines 35-37 where the dark levels associated with each color component is algebraically summed with the signal levels to remove dark current).

Regarding Claim 43, Boisvert et al. disclose a color imaging system for compensating a color response, the system comprising the recited array and color filter and also comprises the recited first, second and third analog compensation units

**Supplemental Box**
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Continuation of: Boxes I - VIII



and array controller (See Figure 1).

B. Claim 38 lacks novelty under PCT Article 33(2) as being anticipated by Freeman (U.S. Patent No. 4,774,565).

Freeman discloses a color imager comprising a first light sensor, a second light sensor, and an interpolation circuit configured to receive a first and second output signal and provide on-the fly-interpolation based on the first and second output signals (Column 5, Lines 9-15).

C. Claims 39-41 lack novelty under PCT Article 33(2) as being anticipated by Yatsuyama et al. (JP10-108209).

Regarding Claim 39, Yatsuyama et al. disclose a method of interpolating a color value in the analog domain in real time comprising receiving first and second analog signals corresponding to the outputs of first and second pixels that are separated from each other and sense light intensity of a first color, and generating an analog interpolation signal used to create a color value for a location between the first and second pixel elements based on the first and second analog signals (See Figure 6 and SOLUTION).

Regarding Claim 40, an image in Yatsuyama et al. is based on the first, second and interpolation signals (See SOLUTION).

Regarding Claim 41, Yatsuyama et al. read a third pixel element located in a line of pixels, skip a fourth pixel element in the line, and read a fifth pixel element located in the line of pixel elements (See Figure 6).

D. Claims 2 and 30 lack inventive step under PCT Article 33(3) as being obvious over Boisvert et al. in view of Younse et al. (U.S. Patent No. 4,805,023).

Regarding Claim 2, Boisvert et al. disclose all of the limitations except for the recited comparator circuit and delay element. However such is well known in the art for correcting an image for pixel defects, as disclosed in Younse et al. (Figure 2; Column 2, Lines 4-27). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate in Boisvert et al. the recited comparator circuit and delay element, as taught in Younse et al., in order to improve image quality by correcting the image for pixel defects.

As to Claim 30, see discussion of Claim 2.

E. Claims 4, 5, 21, 33, 35 and 36 lack inventive step under PCT Article 33(3) as being obvious over Boisvert et al. in view of Sato et al. (U.S. Patent No. 4,245,241).

Regarding Claim 4, Boisvert et al. disclose all of the limitations except that of the recited analog line storage units. However Sato et al. disclose such an arrangement for a color image sensor (See Column 1, Lines 61-65; Column 3, Lines 9-36), a process by which the resolution is enhanced (Column 1, Lines 65-67; Column 3, Lines 34-36). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to configure the Boisvert et al. device to have the filter design of Sato et al. and to employ the recited first and second analog line storage in order to enhance the resolution of the device.

Regarding Claim 5, Boisvert et al. and Sato et al. disclose that the analog storage units are capacitors (See Column 5, Lines 46-59 of Sato et al. where the sample and hold circuits clearly have capacitors).

Regarding Claim 21, Boisvert et al. disclose all of the limitations except that of the readout control circuit and array controller processing a first set of pixel sensor elements and then processes a second set of pixel sensor elements such that the second set overlaps a portion of the first set. However it is well known in the art to so process pixel data of a color image sensor in order to enhance the resolution of the device, as disclosed in Sato et al. (Column 1, Lines 61-67; Column 3, Lines 9-36). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to configure the Boisvert et al. device have the filter design of Sato et al. and to configure the readout control circuit and array controller so as to process a first set of pixel sensor elements and then process a second set of pixel sensor elements such that the second set overlaps a portion of the first set in order to enhance the resolution thereof.

As to Claim 33, see discussion of Claim 21.

F. Claims 8, 17 and 19 lack inventive step under PCT Article 33(3) as being obvious over Boisvert et al.

Regarding Claim 8, although Boisvert et al. is silent regarding the manufacturing process used for the pixel sensor elements, the sensor elements are not limited to a particular CCD element (Column 15, Lines 37-39) and CMOS technology is taught in Column 3, Lines 29-31. Although difficult to implement for the ASPs (Column 3, Lines 29-30), it would have been obvious to use CMOS technology for the pixel elements for applications where low cost, small size and uniform quality are a priority, as suggested in Column 3, Lines 20-21).

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Continuation of: Boxes I - VIII



Regarding Claims 17 and 19, the Boisvert et al. device is not limited to a particular CCD imaging unit or to R,G,B colors (Column 15, Lines 37-39) therefore clearly suggesting to one skilled in the art that complementary colors or a Bayer filter for RGB may be used, both configurations being very well known in the art.

G. Claims 11 and 12 lack inventive step under PCT Article 33(3) as being obvious over Boisvert et al. in view of Zhou et al. (IEEE).

Regarding Claims 11 and 12, Boisvert et al. disclose all of the limitations except those of the programmable amplifiers being contained within the pixel circuitry of the array and within a plurality of column buffers. However such a design for amplifiers used with an image sensor is well known in the art as disclosed in Zhou et al. (See Figures 1 and 2) and clearly would reduce the size of the Boisvert et al. device. Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to configure the Boisvert et al. device so as to have its programmable amplifiers contained within the pixel circuitry of the array within a plurality of column buffers in order to reduce the size of the device.

H. Claim 20 lacks inventive step under PCT Article 33(3) as being obvious over Boisvert et al. in view of Sano et al. (IEEE).

Boisvert et al. disclose all of the limitations except that of a micro-lens layer. However such a design for an image sensor is well known in the art and increases the sensitivity of the device, as disclosed in Sano et al. (Figure 2; Abstract). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to configure the Boisvert et al. device so as to have a micro-lens layer in order to increase its sensitivity.

I. Claims 24 and 37 lack inventive step under PCT Article 33(3) as being obvious over Boisvert et al. in view of Roberts (U.S. Patent No.5,541,654).

Regarding Claim 24, Boisvert et al. disclose all of the limitations except that of the readout control circuit and the array controller only processing a sub-region of the array. However such an operation for an image sensor is well known and increases the utility of the device by permitting output of selected array portions at selected frame rates, as disclosed in Roberts et al. (See Figure 6 and Column 10, Lines 9-20). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to configure the Boisvert et al. device so that its readout control circuit and array controller only processes a sub-region of the array in order to increases its utility by permitting output of selected array portions at selected frame rates.

As to Claim 37, see discussion of Claim 24.

J. Claims 23 and 35 lack inventive step under PCT Article 33(3) as being obvious over Boisvert et al. in view of Yatsuyama et al. (JP10-108209).

Regarding Claim 23, Boisvert et al. disclose all of the limitations except that of the readout control circuit and the array controller processing a first set of pixel sensor elements, skipping a second set of pixel sensor elements and processing a third set of pixel sensor elements. However such an operation for a color image sensor is well known in the art as a means for more efficiently providing missing color information for a given pixel, as disclosed in Yatsuyama et al. (See Figure 6 and SOLUTION). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to conf igure the Boisvert et al. device so that its readout control circuit and array controller processes a first set of pixel sensor elements, skips a second set of pixel sensor elements and processes a third set of pixel sensor elements in order to more efficiently provide missing color information.

As to Claim 35, see discussion of Claim 23.

K. Claim 26 lacks inventive step under PCT Article 33(3) as being obvious over Boisvert et al. in view of Kondo et al. (U.S. Patent No. 5,640,202).

Boisvert et al. disclose all of the limitations except that of a personal computer being coupled to the readout control circuit. However it is well known in the art to couple a personal computer to the readout control circuit of a camera in order to enable advanced image processing of the output image data, as disclosed in Kondo et al. (Column 5, Line 33; Column 2, Lines 38-44). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to couple the Boisvert et al. readout control circuit to a personal computer in order to enable advanced image processing of the output image data.

L. Claim 42 lacks inventive step under PCT Article 33(3) as being obvious over Yatsuyama et al. in view of Roberts.

Yatsuyama et al. disclose all of the limitations except the recited windowing operation. However such an operation for an image sensor is well known and increases the utility of the device by permitting output of selected array portions at selected frame rates, as disclosed in Roberts (See Figure 6 and Column 10, Lines 9-20). Therefore it would have been obvious

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Continuation of: Boxes I - VIII



to one of ordinary skill in the art at the time of the invention to configure the Yatsuyama et al. device so as to perform a windowing operation in order to increase its utility by permitting output of selected array portions at selected frame rates.

M. Claims 44 and 45 lack novelty under PCT Article 33(2) as being anticipated by Dillon et al. (U.S. Patent No. 4,176,373).

Regarding Claim 44, Dillon et al. (Figure 4) disclose amplifying (AR) an analog output from an element of a first color component to produce a first sampled color output and second amplified color output (in circuit 40 for Red); amplifying (AB) an analog output from an element of a second color component to produce a third sampled color output and fourth amplified color output (in circuit 40 for Blue); generating a compensated analog readout (the R output from amplifier 56) of the first color component based on a combination of the first amplified color output and the third amplified color output; and generating a compensated analog readout (the B output from amplifier 58) of the second color component based on a combination of the second amplified color output and the fourth amplified color output.

Regarding Claim 45 , Dillon et al. (Figure 4) disclose modifying (in amplifier 56) a first analog signal (R) corresponding to the output of a first pixel element in an imager to color correct the first pixel, the first pixel element used to sense light intensity of a first color; and modifying (in amplifier 58) a second analog signal (B) corresponding to the output of a second pixel element in the imager to color correct the second pixel wherein the second pixel element is used to sense light intensity of a second color.

N. Claims 46-49 lack novelty under PCT Article 33(2) as being anticipated by Wada et al. (U.S. Patent No. 4,300,163).

Regarding Claim 46, Wada et al disclose an imaging system comprising the recited plurality of pixel sensor elements (See Figure 1; Items 1 and 2), readout controller (Column 3, Lines 32-60) and processing circuit (Column 4, Lines 9-31).

Regarding Claim 47, Wada et al. disclose the recited reading (Column 3, Lines 32-60) and adjusting and repeating steps (Column 4, Lines 9-31).

Regarding Claim 48, see Figure 1 and Column 3, Lines 32-60 and Column 4, Lines 9-31 where the recited first and second modes are interpreted to be dark pixel and light pixel modes of operation.

Regarding Claim 49, Wada et al. disclose the recited method in Column 3, Lines 1-29.

O. Claim 50 lacks novelty under PCT Article 33(2) as being anticipated by Zhou et al.

Zhou et al. discloses a method of averaging two or more pixel sensor elements, the method comprising exposing an array of pixel sensor elements to light (Section II); selecting a plurality of pixel sensor elements from an array of pixel sensor elements (Section III); and averaging a first analog value associated with a first pixel sensor and a second analog value associated with a second pixel sensor element within the array to produce an average readout value (Page 1766, Column 2, first four lines).

P. Claims 51-52 lack novelty under PCT Article 33(2) as being anticipated by Younse et al.

Regarding Claim 51, Younse et al. disclose a pixel sensor element control system comprising the recited array (1), and the recited readout and processing circuit, comparator circuit and delay element (Column 2, Lines 4-27; Column 3, Lines 1-30), where the recited first and second modes are interpreted to be odd and even pixel readouts in keeping with the TV operation of the device (Column 1, Line 17).

Regarding Claim 52, Younse et al. disclose the recited method in Column 2, Lines 4-27 and Column 3, Lines 1-30.

---------- NEW CITATIONS ----------

NONE